

REAPPRAISAL OF THE GASTROPOD GENUS
VARICOPEZA GRÜNDEL (CERITHIIDAE:
PROSOBRANCHIA)

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Abstract.—The genus *Varicopeza* is described and its relationship to the genera *Bittium* and *Argyropeza* is established. This monotypic genus, represented by *Varicopeza pauxilla* (A. Adams), is found in deep sea environments throughout the Indo-West Pacific. A synonymy and new description which includes radular features and aspects of soft anatomy, and an historical review of the literature are presented. The ecology of the species and the functional significance of the shell aperture are discussed.

Numerous lots of a small, *Bittium*-like cerithid dredged by the R.V. *Albatross* in the Philippine archipelago and deposited in the National Museum of Natural History, Smithsonian Institution have prompted this review. This small cerithid belongs to the monotypic genus *Varicopeza* Gründel, 1976 and has long been overlooked or misidentified in most museum collections where it is frequently found mixed with other small cerithid species. Closely related to the genera *Argyropeza* and *Bittium*, *Varicopeza pauxilla* (A. Adams) has a long synonymic history and has been largely ignored in the literature, except when mentioned incidentally.

In this review, I have examined material from the major American and Australian museums and several other institutions. The sparse anatomical material available for study was poorly preserved. I have surveyed the literature as completely as possible. Whenever possible, types of all nominal species were examined. Scanning electron micrographs were made of the radula, shell and operculum and preserved specimens examined for gross anatomy.

The following abbreviations appear in the text: AMS, Australian Museum, Sydney; ANSP, Academy of Natural Sciences of Philadelphia; BM, Berlin Museum; BM(NH) British Museum (Natural History); NMV, National Museum, Victoria; TAU, Tel-Aviv University; USBF, United States Bureau of Fisheries; USNM, United States National Museum of Natural History; WAM, Western Australian Museum.

Family Cerithiidae Fleming, 1828
Genus *Varicopeza* Gründel

Varicopeza Gründel, 1976:46, plate 1, figures 11-13. Type-species: by tau-

tonomy, *Varicopeza varicopeza* Gründel, 1976 [= *Varicopeza pauxilla* (A. Adams, 1854)].

Description.—Small, slender turreted shell characterized by flat-sided whorls, deeply impressed suture and overall sculpture of spirally beaded bands and axial riblets. Body whorl wide with distinctive thick varix opposite outer lip. Aperture wide with flaring outer lip and wide, deeply impressed, anterior, inhalant, siphonal canal; wide, spoutlike, posterior exhalant canal in upper outer lip directly opposite anterior siphonal canal. Protoconch smooth with convex whorls. Operculum ovate, paucispiral and with subcentral nucleus. Radular ribbon taenioglossate (2+1+1+1+2) with thin, sicklelike lateral teeth and marginal teeth serrated with tiny denticles. Rachidian tooth with long, spadelike, basal plate, two tiny, basal denticles and a long central tooth.

Etymology.—Varix-foot, from the Latin, *varix*, “dilatation” or “varix” and *pes*, “foot.” *Varicopeza* is a feminine Latin noun.

Remarks.—This monotypic genus is widely distributed throughout the Indo-West Pacific geographic province where it is confined to the continental shelf and slope. The animal, shell, opercular and radular characters all indicate a close relationship to the genera *Bittium* Gray, 1847, and *Argyropeza* Melvill and Standen, 1901. The spoutlike exhalant siphonal canal in the upper part of the outer lip of the type-species (see Fig. 1 a–e, j) is so different from anything seen in *Bittium* or *Argyropeza* species that I believe recognition of the genus *Varicopeza* Gründel, 1976 to accommodate the species is justified, both on morphological and functional grounds.

The genus *Varicopeza* is not known from the fossil record. On the basis of shell sculpture, Gründel (1976) believed the genera *Varicopeza* and *Argyropeza* Melvill and Standen, 1901 to be Recent representatives of the family Procerithiidae Cossmann, 1905, subfamily Cryptaulinae Gründel, 1976, and placed *Bittium* in the same family. I find Gründel’s classification too dependent on unimportant shell characters and topheavy with supra-specific taxa; consequently, I prefer to regard *Varicopeza* as a genus in the Cerithiidae until there is more solid information upon which to base supra-specific categories.

Varicopeza pauxilla (A. Adams, 1854)

Figs. 1–2

Cerithidea (*Pirenella*) *pauxilla* A. Adams, 1854:86 (Holotype: BM(NH), not registered; Type-locality: Burias, Philippines).

Cerithium pauxillum (A. Adams). Sowerby, 1855:889–890, pl. 186, fig. 294 (non Pease, 1860); Reeve, 1865, pl. 20, fig. 144; Tryon, 1887:141, pl. 34, fig. 95; Kobelt in Martini Chemnitz, 1898:228, pl. 40, fig. 8; Schepman, 1909:162; Oostingh, 1925:45.

Cerithium bicanaliferum Brazier, 1877:317 (Lectotype: AMS A-72, here selected; 7 paralectotypes; Type-locality: 30 fathoms, Darnley Id., Torres Straits, Queensland, Australia); Hedley, 1901:127, pl. 17, fig. 25; Ponder, 1972:45.

Cerithium trigonostomum Melvill, 1910:10, pl. 1, fig. 15 (Lectotype: BM(NH), not registered, largest from F. W. Townsend Collection, here selected; 3 paralectotypes, two with Reg. No. 1912.8.16.97-8: Type-locality: 40 fathoms, Merkan Coast, Charbar [Pakistan]).

Argyropeza involuta Thiele, 1918:120, pl. 21, figs. 20, 20a (Holotype: BM, not registered; Type-locality: sta. 245, 5°27.9', 39°18.8'E at 463 meters (near Zanzibar)).

Varicopeza varicopeza Gründel, 1976:46–48, figs. 8, 11, 12, 13 (Holotype: BM, not registered; Type-locality: 0°30'S, 107°5'W, South China Sea).

Description.—*Shell* (Fig. 1 a–e, g–j): Shell small, about 7 mm long, 2.2 mm wide, thin, slightly transparent, slender and turreted, having apical angle of 24 degrees and white to light tan in color. Teleoconch comprises 8–13 straight-sided whorls that angle sharply inwards on each side at the deeply impressed suture to form distinct sutural ramps. Each whorl sculptured with raised spiral cords and broader, less distinct axial riblets. Where cords cross ribs, small, sharp beads appear, giving an overall spiny appearance. Early whorls of teleoconch have only 2 spiral cords; mid-whorls and penultimate whorl each with 3 dominant spiral cords and one weaker spiral cord on the upper and lower sutural ramp. Protoconch of 3.5 concave, smooth whorls the last 2 of which are sculptured with a centrally located microscopic spiral thread. Lip of protoconch sinuous, thickened into spout-like exhalant siphon at upper surface. Body whorl broad, with wide, prominent varix opposite outer lip. Sculpture of body whorl comprises 4 raised, primary spiral cords. Between each of these, is a thinner, raised spiral cord. Base of body whorl constricted at siphonal area and sculptured with 6–7 thin, raised spiral cords. Outer lip crenulate, flaring and thickened on outside, due to lip varix. Aperture triangular-ovate with concave, smooth columella and wide, anterior inhalant siphonal canal that is turned to the left 45 degrees to shell axis. A prominent posterior exhalant siphonal canal is formed by spoutlike notch in upper, outer lip directly opposite to, and in line with, anterior siphonal canal.

Operculum: (Fig. 1f) Operculum corneous, thin, ovate and paucispiral with a subcentral nucleus. Operculum fits aperture snugly when animal is retracted into shell, and has a very thin, flexible border.

Radula: (Fig. 2) Radular ribbon taenioglossate, tiny, about one-ninth the length of the shell, and comprising about 20 rows of teeth. Rachidian tooth shield-shaped with spadelike basal plate upon which are 2 thickened, but small basal cusps. Top of rachidian tooth straight with long, pointed, central

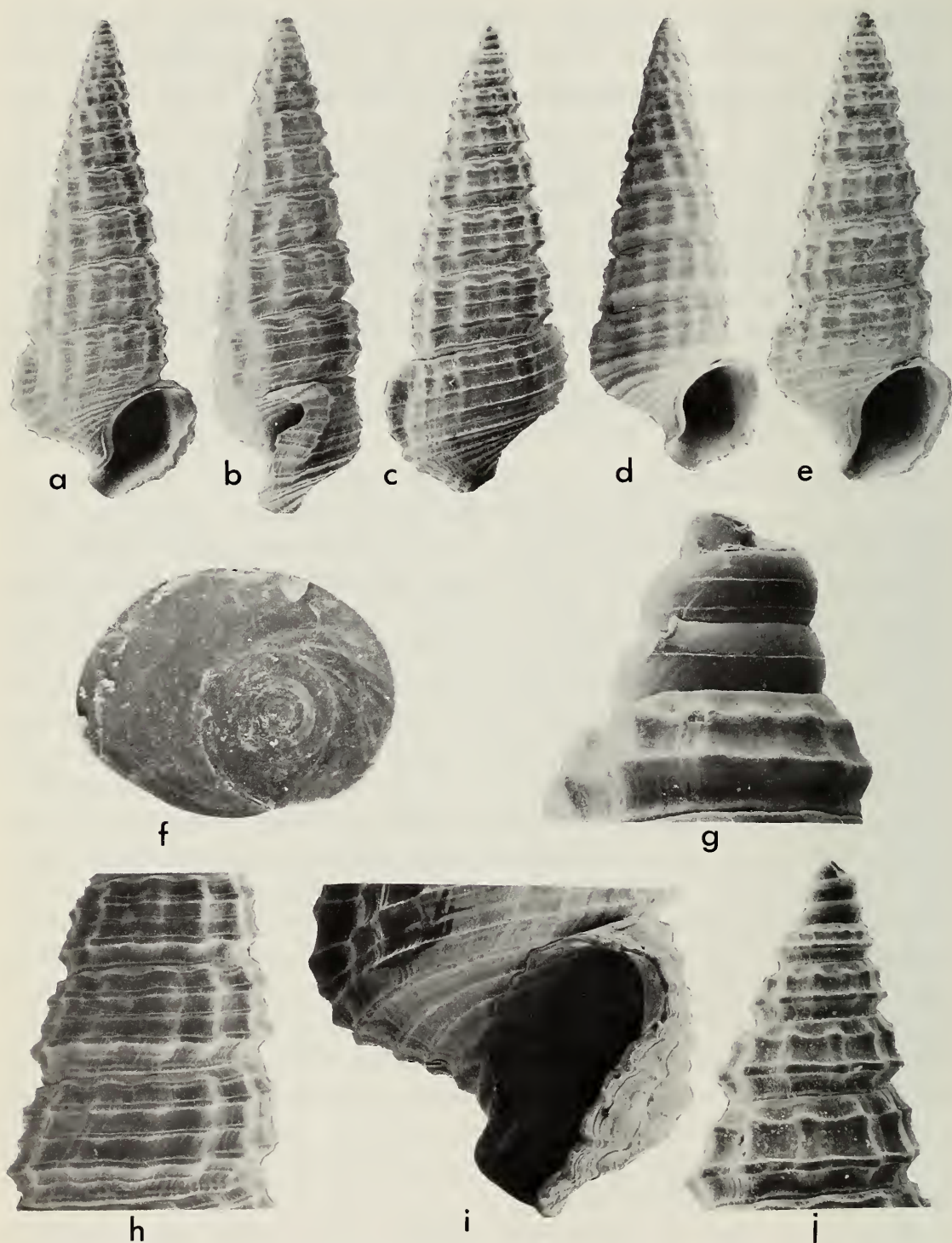


Fig. 1. *Varicopeza pauxilla*, scanning electron micrographs showing shell physiognomy and operculum. a-d, Apertural, side, dorsal and apertural views of adult shells, all USBF Station 5435, 80 meters, soft mud, off Nagubat Id., E. Mindanao, Philippines (USNM 276898), 30 \times ; e, Adult shell, 52 meters off Mersat Abu Samra, Gulf of Aqaba, Israel (USNM unaccessioned) 30 \times ; f, Operculum of specimen from USBF Station 5426, 49 meters, off Mantaquin Id., E. Palawan, Philippines (USNM 288300), 75 \times ; g, Enlargement of protoconch showing sculptural details and spoutlike notch in protoconch lip, 75 \times same data as in a-d; h, Detail of sculpture



Fig. 2. Scanning electron micrographs of radula of *Varicopeza pauxilla*. **a**, Radular ribbon with some marginal teeth folded back to expose lateral teeth, 500 \times ; **b**, Enlargement of rachidian and lateral teeth, 1,000 \times ; **c-d**, Marginal teeth showing cusp placement on inner and outer marginals, 600 \times , 1,000 \times .

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on penultimate and adult whorls, 55 \times , same data as a-d; **i**, Close-up of aperture showing exhalant siphonal canal, 200 \times , same data as a-d; **j**, Detail of early whorls of teleoconch, 55 \times , same data as a-d.

tooth flanked by 3–4 small denticles on each side. Lateral tooth rhomboid with straight top, serrated with one inner sharp denticle, a larger, triangular pointed tooth, and with 6–7 smaller pointed denticles. Basal plate of lateral tooth smooth, flat, with long, lower lateral extension onto basal radular membrane. Inner marginal tooth long, hooklike and tapering to pointed tip, serrated on both sides with 3–5 tiny denticles. Outer marginal tooth same, only smooth on outer surface. Basal half of each marginal tooth becomes wider and flatter where it is inserted onto the basal radular membrane.

Animal: Head-foot of preserved animals large and with deep groove emerging from exhalant siphon and extending down right side of foot. Snout long, bilobed at tip. Eyes very large in relation to animal. Mantle edge with short, thick pallial tentacles. Organs of mantle cavity and internal anatomy unknown. Eggs and larvae unknown.

Etymology.—From the Latin, *pauillus*, “little,” “small.”

Discussion

Synonymy.—This species was first described by A. Adams (1854) as a *Cerithidea* species, family Potamididae H. and A. Adams, 1854, but was considered a *Cerithium* species by Sowerby (1855; 1865), Tryon (1887) and Kobelt (1898). Shell sculpture, radular and opercular characters substantiate its proper assignment to the Cerithiidae. Adams' (1854) original diagnosis was without a figure but described a “yellowish-brown shining species with deeply channeled sutures, and with the whorls ornamented with 3 series of rather acute tubercles.” His description also noted the unusually shaped aperture with sinuous lip and the posterior siphonal canal. Examination of the holotype shows it to be conspecific with recent material and the other synonyms given above.

The nominal species, *pauilla*, has been overlooked because of the poor, tiny figures in Sowerby (1855; 1865) and the other classical iconographies which do not clearly illustrate the sculpture or distinctive features of the aperture. As a result, a number of names have been proposed, as can be seen in the above synonymy. The homonym, *Cerithium pauillum* Pease, 1860, is a different species.

The earliest synonym is *Cerithium bicanaliferum* Brazier, 1877. This name appropriately describes the unique siphonal canals. The names *bicanaliferum* and *pauillum* were missed by Melvill (1910), who named the species, *trigonostomum*, “triangular mouth.” The type-material of *C. trigonostomum* comprises 4 specimens, 2 of which were purchased by Sowerby and Fulton and have the registry number 1912.8.16.97-8. The other 2, lacking registry numbers, are from the F. W. Townsend collection. I select the best preserved specimen from the Townsend collection as the lectotype of *C. trigonostomum* because Melvill's (1910) paper was written about the mollusks collected by Townsend.

Gründel (1976) proposed the genus *Varicopeza* to accommodate what he thought was a new species and was apparently unaware of the other available specific names.

Examination of the holotype of *Argyropeza involuta* Thiele, 1918, has convinced me that it is conspecific with *Varicopeza pauxilla*. Thiele's specimens are both immature individuals lacking outer lips and were erroneously assigned by him to the genus *Argyropeza* Melvill and Standen, 1901. Although related to the genera *Bittium* and *Varicopeza*, *Argyropeza* species differ in having a distinctive protoconch sculpture of 2 spiral cords, a spiral row of beads adjacent to the suture, and a sinusigera notch.

Remarks.—*Varicopeza pauxilla* is a common species, widely distributed throughout the continental shelf and slope regions of the Indo-West Pacific biogeographic province.

The color of this species is variable. Dead collected specimens tend to be chalky white while freshly collected material is white or light tan and of porcellaneous texture. Some shells are flesh colored or dark tan: a series of specimens from Palau (ANSP 203855;203483) ranged in color from white to brown, many being striped with a dark tan band on the lower half of each whorl. A summary of the shell dimensions and characters is presented in Table 1, below:

Table 1.—Statistical summary of shell measurements (mm) of *Varicopeza pauxilla*.

Character	Number	Range	Mean	S.D.
Length	64	3.5–9.6	6.89	1.3
Width	64	1.4–2.8	2.15	0.35
Aperture length	64	0.5–2.0	1.21	0.35
No. whorls	64	8–14	11.3	1.29

Adults, with fully formed body whorl, varix, outer lip, and two siphonal canals are so distinctive that they are unlikely to be confused with any other small, deep-sea cerithid (Fig. 1a–e). Immature individuals or shells without the outer lip may be difficult to identify without close examination of the distinctive sculptural pattern. *Varicopeza pauxilla* may be confused with young individuals of *Rhinoclavis (Proclava) sordidula* (Gould, 1849) which have similar sculpture. The latter species differs by being much larger and in having a median columellar plait in the aperture and a sutural ramp only on the bottom portion of each whorl.

Cerithium elegantissimum Hedley, 1899 resembles *Varicopeza pauxilla* in that the outer lip flares slightly, forming a weak exhalant posterior siphonal canal, but the shell is less slender and has different sculpture. The former is clearly more like *Bittium* and forms a morphological link between that genus and *Varicopeza*.

Cerithium scabriusculum Issel, 1869, may be a synonym of *Varicopeza*

pauxilla. I have not examined the type-material, but Issel's (1869:pl. 3, fig. 11) illustration looks somewhat close to *Varicopeza pauxilla*.

Varicopeza pauxilla may also be mistaken for a turrid species because of the similarity of the exhalant posterior siphonal canal to the "turrid notch." Turrids however, normally have narrower apertures and slightly longer anterior siphonal canals.

Ecology.—The ecological information available suggests that this deep-sea species is a microphagous detritivore and perhaps a filter feeder, as well. It lives in great numbers on soft or fine sandy-muddy bottoms and has a radula that is morphologically and functionally similar to those of *Bittium* species. The numerous rod-shaped, ovoid fecal pellets of fine detrital particles are relatively large in comparison to the size of the animal, indicating a continuous feeding habit. The deep groove leading from the exhalant siphon down the right side of the foot probably conveys mucous, fecal pellets and other debris away from the animal. It is more pronounced than in other cerithid species. The functional significance of the wide, exhalant, posterior siphonal canal may be explained in terms of filter feeding on a soft substratum. The inhalant and exhalant siphonal canals allow the animal to lie with its aperture tangential to the surface of the substratum and may expedite the flow of water and detrital particles through the mantle cavity. Normal grazing activity can also take place. It does not appear that the animals are partly buried in the sediment because none of the specimens examined were eroded or worn on the dorsal or ventral surfaces of their shells. I thus suggest that this small cerithid snail grazes and filter feeds at the water-substratum interface.

Many specimens examined from the Philippines, Palau, and the Andaman Sea were drilled, indicating heavy predation by naticid snails. Many empty shells from Palau contained sipunculids.

Although the protoconch is large, consisting of 3.5 whorls, the smooth sculpture and spout-like notch (Fig. 1g) in the upper edge of the outer protoconch lip and the absence of a sinusigera notch point to a direct or demersal developmental mode rather than to an indirect, pelagic one.

Geographic distribution (Fig. 3).—The bathymetric range of this species is summarized in Table 2. The geographic range is confined to the Indo-West Pacific province. The one record from Bikini Atoll, Marshall Islands, indicates that this species may yet be found in other areas of Micronesia and possibly in Polynesia.

Specimens Examined

GULF OF AQABA: off Elat, 167 m; Elat, 121 m; Elat, 40–49 m; off Mersat Abu Samra, 52 m; off Wadi Murach, 80–82 m; off Gesirat Fara'un, 64–73 m; Elat, from beach; off Nuweiba el Tarabin, 143–146 m; off Nuweiba

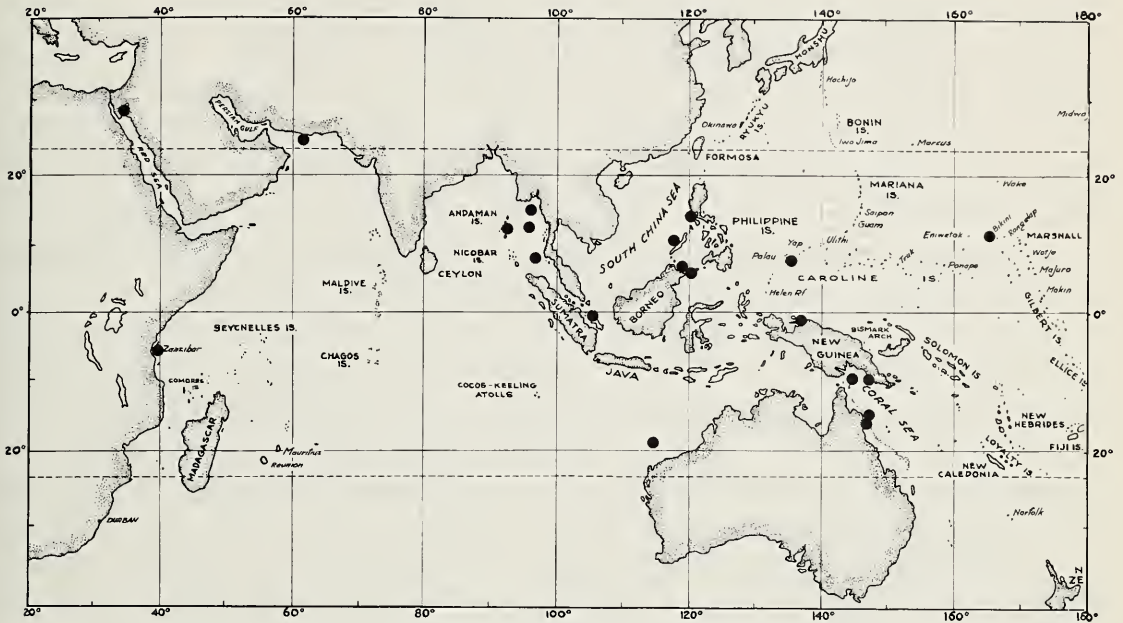


Fig. 3. Geographic distribution of *Varicopeza paxilla* (A. Adams).

el Museina, 329–402 m (all USNM 783672–783678). ZANZIBAR: 5°27.9'N, 39°18.8'E, 463 m, near Zanzibar (BM); 2 mi. W of Nyange Id., 20 m (ANSP 251215). INDIA: 10 mi. SE of Vizagapatnam, 58 m, Bay of Bengal (ANSP 294094). BURMA: 15°08'N, 99°04'E, 50 mi. SW of Irrawaddy River, Pre-paris N. Channel, 53 m (ANSP 293491). ANDAMAN SEA: 13°N, 97°4'E, 35 mi. W of Tavoy Id., Andaman Sea, 68 m (ANSP 292782); 08°29'N, 97°59'E, 25 mi. NNW of Phuket Id., W. Thailand, 42 m (ANSP 291467; 291826); 12°01'N, 92°55'E, 14 mi. NNW of Port Blair, off S. Andaman Ids., 49 m (ANSP 292348). WESTERN AUSTRALIA: Approximately 170 mi. W of Port Hedland, W.A., 19°29'S, 116°01'E, 137 m (AMS). QUEENSLAND, AUSTRALIA: off Endeavour Reef, N of Cooktown, 37 m (AMS); Dornley Id., Torres Straits, 55 m (AMS A-72); Palm Id., N of Townsville, 27 m (AMS C10188); Low Isles, near Port Douglas (AMS); Palm Id., (NMV). NEW GUINEA: 1–2 mi. off Kaipori Village, Koeroedoe Id., Geelvink Bay, 15 m (ANSP 277870); 1 mi. S by E. Cape Dgaroewawoffi, Japen Id., Geelvink Bay 12–29 m (ANSP 277723); W end Manubada (Local) Id. off Port Moresby, Papua, 18–22 m (AMS). PALAU: 1–1.5 mi. off

Table 2.—Bathymetric range of *Varicopeza paxilla*.

No. of stations	Depth range (meters)	Mean depth	S.D.
48	11–686	90.92	122.36

Garakasan Point, E side of Babelthaup (ANSP 203855); off Malakal Harbor, 46–55 m (ANSP 236589; 203483). MARSHALL ISLANDS: 3 mi. SW of Bikini Id., Bikini Atoll, 46 m (USNM 586688). PHILIPPINES: off SE Tawi-tawi, 33 m (USNM 283634); Palawan Pass, off Cauayan Id., 95 m (USNM 258481); Linapacan Str., off Observatory Id., Palawan, 84 m (USNM 282437); SE off Bantayan Id., 59 m (USNM 281081); S off Corregidor Lt., 55 m (USNM 263530); off Toccanhi Pt., Tawi-tawi, 90 m (USNM 274414); off Nagubat Id., E. Mindanao, 80 m (USNM 276898); off Mantaquin Id., E. Palawan, 49 m (USNM 288300); off Tacbuc Pt., E. Leyte, 88 m (USNM 282853); off Tacbuc Pt., E. Leyte, 104 m (USNM 283184); Linapacan Str., off Observatory Id., 84 m (USNM 282792); off Tinakta Id., Tawi-tawi Is., 29 m (USNM 257689); Linapacan Str., off Observatory Id., Palawan, 84 m (USNM 291621); off S. W. Tawi tawi, 33 m (USNM 312733); off Malavatuan Id., W. Luzon, 33 m (USNM 278223); off Observatory Id., Palawan Pass, 79 m (USNM 282334); off Observatory Id., Palawan Pass, 79 m (USNM 282023); off Tinakta Id., Tawi tawi, 29 m (USNM 257690); Palawan Pass, off Pt. Tabonan, 686 m (USNM 285856); off Sueste Pt., W. Luzon, 46 m (USNM 262609); off S.W. Tawi tawi, 33 m (USNM 312727); Malampaya Sound, Palawan, 11 m (USNM 286138); S.E. off Bantayan Id., 59 m (USNM 281061). BORNEO: off Sandakn Lt., 71 m (USNM 285765).

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Literature Cited

- Adams, A. 1854. A monograph of *Cerithidea*, a genus of Mollusca, with descriptions of several new species, from the collection of Hugh Cuming, Esq.: To which are added, descriptions of two new species of *Colina*, and one of *Donax*.—Proceedings of the Zoological Society of London 22:83–87.
- Brazier, J. 1877. Shells collected during the Chevert Expedition.—Proceedings of the Linnaean Society of New South Wales 1:311–321.

- Cossmann, M. 1905. Mollusques éocéniques de la Loire-Inférieure.—Bulletin de la Société des Sciences naturelles de l'ouest de la France 3(2):68–123 (135–189), pls. 1–6 (9–14).
- Fleming, J. 1828. Mollusks. Encyclopedia Britannica, supplement to editions 4–6, volume 3, part 1. Edinburgh.
- Gould, A. A. 1849. Shells “brought home by the U.S. Exploring Expedition.”—Proceedings of the Boston Society of Natural History 3:106–108.
- Gray, J. E. 1847. The classification of the British Mollusca by N. E. Leach, M.D.—Annals and Magazine of Natural History 20:267–273.
- Gründel, J. 1976. Zur Taxonomie und Phylogenie der *Bittium*-Gruppe (Gastropoda, Cerithiacea).—Makakologische Abhandlungen Staatliches Museum für Tierkunde in Dresden 5(3):33–59. 2 pls., 17 figs.
- Hedley, C. 1899. The Mollusca of Funafuti Atoll.—Memoir of the Australian Museum 3(7):397–567, 80 figs.
- . 1901. A revision of the types of the marine shells of the Chevert Expedition.—Records of the Australian Museum 4(3):121–130, pls. 16–17.
- Issel, A. 1869. Malacologia del Mar Rosso.—Biblioteca Malacologica. 387 pp., 5 pls. Pisa.
- Kobelt, W. 1888–1898. Die Gattung *Cerithium*, 297 pp., 47 pls.—In Martini, F. H. S. and J. H. Chemnitz, Neues systematisches Conchylien-Cabinet, etc. 1(26). Nurnburg.
- Melvill, J. C. 1910. Descriptions of twenty-nine species of marine mollusca from the Persian Gulf, Gulf of Oman, and North Arabian Sea, dredged by Mr. F. W. Townsend, of the Indo-European Telegraph Service, 1901–1903.—Annals and Magazine of Natural History (8)6:1–17, pls. 1–2; 289–324, pls. 20–23.
- Melvill, J. C. and R. Standen. 1901. The mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea, as evidenced mainly through the collections of Mr. F. W. Townsend, 1893–1900, with descriptions of new species.—Proceedings of the Zoological Society of London 2:327–400, pls. 21–24.
- Oostingh, C. E. 1925. Report on a collection of Recent shells from Obi and Halmahera (Moluccas).—Mededeelingen van de Landbouwhoogeschool te Wageningen (Nederland) 29(1):3–362.
- Pease, W. H. 1860. Descriptions of forty-seven new species of shells from the Island of Ebon, Marshall's Group, in the collection of H. Cuming.—Proceedings of the Zoological Society of London, pp. 431–438.
- Ponder, W. F. 1972. Type specimens in the Macleay Museum, University of Sydney. VI. Mollusks.—Proceedings of the Linnaean Society of New South Wales, vol. 97, part 1, no. 429:42–55.
- Schepman, M. M. 1909. The Prosobranchia of the Siboga-Expedition.—Siboga-Expeditie 49(43):100–231, 7 pls. Leiden: Brill.
- Sowerby, G. B. 1855. Thesaurus Conchyliorum, or monographs of genera of shells.—Vol. 2, *Cerithium*: 847–859, pls. 176–186. London.
- . 1865. *Cerithium*, 20 pls. + index in Reeve, L. A., Conchologia Iconica: or illustrations of the shells of molluscous animals. Vol. 15. London.
- Thiele, J. 1918. Gastropoda der Deutschen Tiefsee-Expedition, pt. 2.—Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer “*Valdivia*” 1898–1899, 17(2):1–382. Jena.
- Tryon, G. W. 1887. Manual of Conchology; structural and systematic; with illustrations of the species.—First series: 9a, *Cerithium*, pp. 127–149, pls. 20–29. Philadelphia.

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